

Treatment of arrow wounds by nineteenth century USA army surgeons

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The discovery of gold in 1848, within the Indian territory of California, caused a rapid massive influx of white prospectors which led inevitably to conflict with the Indians. The favoured weapon of the Indians was the bow and arrow, despite the fact that guns were becoming increasingly available to them¹. A skilled warrior could discharge up to six arrows a minute. US Army surgeons had extensive experience of Civil War battlefield surgery for bullet wounds, but had little or no experience of arrow wounds. Bullet wounds, if not initially fatal, generally required cleaning but not immediate surgical exploration. In contrast, arrows traversed the body wall through well-defined smooth slit wounds and lodged deep in tissues. This resulted in severe profuse haemorrhage. Therefore, to treat arrow wounds, Army surgeons had to learn to modify their practice often having to perform extensive operations at the combat site.

Arrowheads were loosely attached to their shafts with narrow wrappings of animal tendon, which disconnected when moistened within the body². Contrary to surgical advice, panicked victims would often rip out the shaft and leave the abandoned arrowhead to act as a constant tissue irritant. If immediate haemorrhage did not occur, the overlying tissue would reorganize and disrupt the entrance tract. Arrowheads occasionally became encysted, which required major operations to retrieve them.

One tribe's arrow wounds caused different types of injury than another. Apaches, for example, used stone arrowheads which shattered bone, whereas Plains Indians used iron arrowheads which embedded in deep tissue². Several tribes poisoned their arrows with a variety of toxins including rattlesnake venom³. However, this was the exception rather than the rule, despite folklore beliefs to the contrary.

Much of our knowledge of these injuries is due to the detailed descriptions of the US Army Surgeon Major Joseph H Bill¹. Limb injuries were the most common followed by chest and abdominal injuries. They were the injuries least often fatal, with less than 5% mortality⁴. When the arrow passed clean through a limb, treatment was by simply cleaning and dressing and these wounds healed quickly. On the high dry tablelands of New Mexico this usually took only 2 days. More commonly, the arrow would embed in bone. If it was not immediately removable, the limb was splinted and a type of tube drain inserted. Strong compression bandaging was used to restrict limb

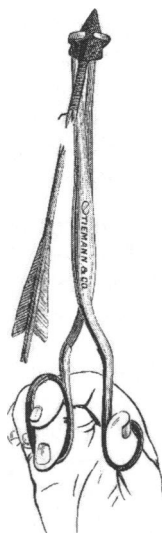


Figure 1. Arrow extracting forceps designed by Major Joseph H Bill

movement and prevent burrowing of the arrowhead. The wound would then be re-explored and if the arrow could not be removed as was often the case, a general anaesthetic, usually chloroform and ether was administered at about 7-10 days post injury³. At operation, great traction was often necessary to remove the arrow. Dr Bill invented specific arrow extracting forceps which locked around the arrowhead (Figure 1)¹. Re-exploration was invariably necessary to drain collections and postoperative recovery was prolonged.

Approximately half of the chest injuries occurred with underlying lung injury, which was usually fatal. Arrows tended to lodge in the posterior ribs rather than traverse the chest cleanly (Figure 2)¹. Surgeons would identify the posterior rib involved by tapping on the feathered end anteriorly while palpating posteriorly. The arrowhead was then removed together with the part of posterior rib involved using

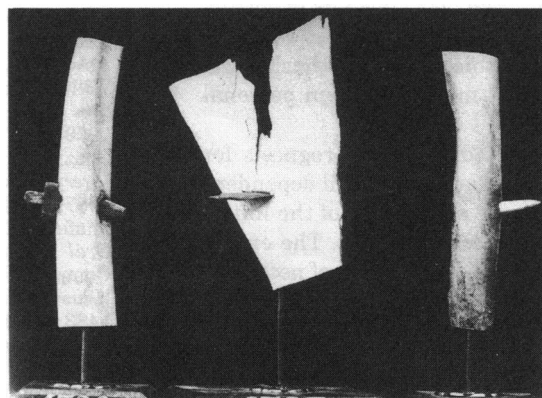


Figure 2. Arrowheads embedded deeply in posterior ribs

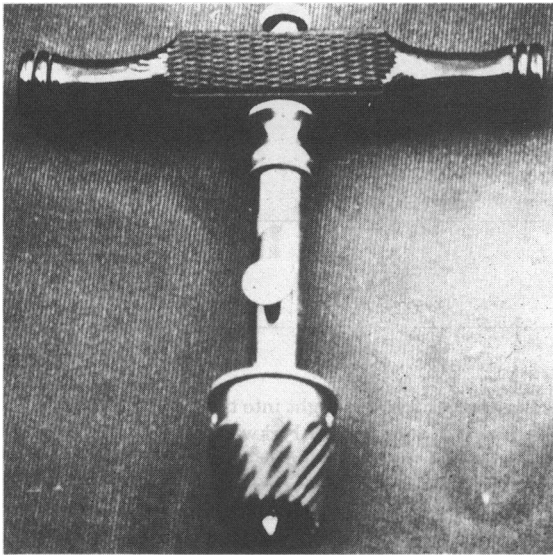


Figure 3. Trephine used by US Army Surgeons to remove arrowheads

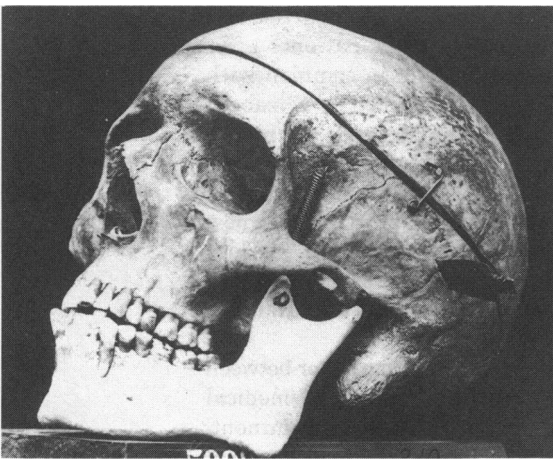


Figure 4. US Army soldier's skull with arrowhead embedded in temporal region

a trephine (Figure 3). In one case, Dr Bill could not remove the arrowhead and the soldier made an uneventful recovery. In fact, at an army medical examination several years later, he was certified as completely fit!

Abdominal injuries had a mortality rate of approximately 90%. Death was usually due to immediate haemorrhage or subsequent peritonitis. Mexican

soldiers unlike US cavalry soldiers were well aware of this and wrapped blankets around the abdomen before going into battle with the Indians⁵. When soldiers survived the initial haemorrhage and an arrowhead remained within the abdomen, a mini-laparotomy was performed. The surgeon would pass a looped wire over the arrowhead in order to cover the barbs and avoid tissue damage as it was withdrawn. If bowel contents were seen, a full laparotomy was performed and any perforated bowel was repaired with catgut or thin gold wire. Sometimes, it was impossible to remove the arrowhead. One notable survivor had persistent urinary incontinence for years after his injury. Removal of an enormous bladder calculus with an arrowhead at its centre caused complete cure⁶!

Head injuries were almost invariably fatal (Figure 4)². However, occasionally an arrow would hit the side of the head and cause a depressed skull fracture without underlying brain injury. There are several reported cases in which traction on the arrow to remove the arrowhead reduced the depressed fracture! Very rarely, heroic neurosurgical procedures were performed. The US Army Surgeon CC Gray once removed an arrow which had entered the orbit and lodged between the dura and skull. He reported an extremely delicate procedure utilizing a Hey's saw! The patient apparently made an uneventful recovery⁶.

These days US Army surgeons are amongst the most skilled and experienced trauma surgeons in the world. Many of the important surgical principles that they adhere to were developed by their US cavalry forefathers while facing the new surgical challenge of the arrow wounds.

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